

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In the In the application of: Keller et al.

Serial No.: 10/808,266

Filed: 03/17/2004

For: OLIGOMERIC HYDROXY ARYLETHER PHTHALONITILES AND SYNTHESIS
THEREOF

Examiner: Truong, Duc

Art Group Unit: 1711

October 23, 2007

REPLY BRIEF

RELATED APPEALS AND INTERFERENCES

The present application and US Patent Application No. 10/808,264 are both divisional applications of the same parent application, US Patent 6,756,470. A decision on appeal in 10/808,264 has been rendered. A copy of the decision is included in an appendix to this brief.

In addition to the arguments in the Appeal Brief, Applicants assert the following in response to the Examiner's Answer.

A. Claims 14-21 and 38-46 recite subject matter that is not unpatentable under 35 U.S.C. § 103(a) over Keller ('471) as the reference is not enabling

Claims 14 (15-21 dependent thereon) and 38 (39-46 dependent thereon)

The Examiner's Answer states that "the reference does disclose a similar formula." Page 6, line 3. However, the Examiner has not cited to any part of the reference as an enabling disclosure for the formula.

B. Claims 47-56 recite subject matter that is not unpatentable under 35 U.S.C. § 103(a) over Keller ('760 or '926)

Claim 47 (48-56 dependent thereon)

The Appeal Brief misstated the disclosure of Keller ('760 or '926), stating that the references disclose reacting a dihydroxyaromatic with a dihaloaromatic in the presence of a copper compound and a base (page 4, lines 19-21). No copper compound is actually disclosed in this step. This was correctly stated in a subsequent paragraph. Applicants' representative regrets the error. However, the Examiner's Answer admitted that Applicants were correct in stating that the references do not disclose a copper compound in the first step.

The Examiners Answer stated that since the references disclose the use of copper in the curing step, which occurs after reacting the product of the first step with a nitrophthalonitrile, this indicates that the copper does not have any functionality in the first step (page 6, lines 17-19). This does not logically follow. The fact that copper may be useful in one step (curing) does not imply that it is not useful in any other step (first step). The use of copper in the first step expands the range of possible dihydroxyaromatics and dihaloaromatics and could have an effect even with the dihydroxyaromatics and dihaloaromatics disclosed in the references. While the present claims are not limited to the expanded set of dihydroxyaromatics and dihaloaromatics, the references do not disclose the use of copper in the first step at all.

CONCLUSION

For the reasons stated above and in the Appeal Brief, reversal of the rejections under 35 U.S.C. § 103 is earnestly solicited.

In the event that a fee is required, please charge the fee to Deposit Account No. 50-0281, and in the event that there is a credit due, please credit Deposit Account No. 50-0281.

Respectfully submitted,



Joseph T. Grunkemeyer
Reg. No. 46,746
Phone No. 202-404-1556
Office of the Associate Counsel
(Patents), Code 1008.2
Naval Research Laboratory
4555 Overlook Ave, SW
Washington, DC 20375-5325

APPENDIX C

A copy of the BPAI decision in US Patent Application No. 10/808,264 is attached.

The opinion in support of the decision being entered today is *not* binding precedent of the Board.

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte TEDDY M. KELLER, and DAWN D. DOMINGUEZ

Appeal 2007-0650
Application 10/808,264
Technology Center 1700

Decided: June 27, 2007

Before BRADLEY R. GARRIS, CHARLES F. WARREN, and
CATHERINE Q. TIMM, *Administrative Patent Judges*.

TIMM, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellants appeal under 35 U.S.C. § 134(a) from the
Examiner's decision rejecting claims 1, 2, 22, 23, 26, 27, 56, and 58.¹
We have jurisdiction under 35 U.S.C. § 6(b). We affirm-in-part.

¹ Claims 3-7, 24, 25, 28-31, and 57 are pending, but are not rejected by the Examiner.

I. BACKGROUND

The invention relates to a polyaromatic ether, a process of preparing the polyaromatic ether, and a process of preparing an oligomer based on the polyaromatic ether. Claims 1, 22, and 26 are illustrative of the subject matter on appeal:

1. A polyaromatic ether comprising the formula:

$-(\text{O}-\text{Ar}-)_n-$;

wherein Ar is an independently selected divalent aromatic radical with or without substituents containing one or more fused aromatic rings, one or more non-fused aromatic rings without intervening functional groups, or combinations thereof wherein the radical sites are on the same or different aromatic rings; and

wherein n is an integer greater than or equal to 7.

22. A process of preparing a polyaromatic ether comprising the formula:

$-(\text{O}-\text{Ar}-)_n-$;

wherein Ar is an independently selected divalent aromatic radical with or without substituents containing one or more fused aromatic rings, one or more non-fused aromatic rings without intervening functional groups, or combinations thereof wherein the radical sites are on the same or different aromatic rings;

comprising the step of reacting a dihydroxyaromatic with a dihaloaromatic;

wherein neither the dihydroxyaromatic nor the dihaloaromatic is present in an excess amount; and

wherein the reaction is performed in the presence of a

copper compound and a base.

26. A process of preparing an aromatic ether oligomer comprising the formula:

$$T-Ar-(-O-Ar-)_n-T ;$$

wherein Ar is an independently selected divalent aromatic radical with or without substituents containing one or more fused aromatic rings, one or more non-fused aromatic rings without intervening functional groups, or combinations thereof wherein the radical sites are on the same or different aromatic rings;

wherein T is terminating group independently selected from the group consisting of -OH and -X;

wherein X is independently selected from the group consisting of Br and I;

wherein n is an integer greater than or equal to 1;

comprising the step of reacting a dihydroxyaromatic with a dihaloaromatic;

wherein the reaction is performed in the presence of a copper compound and a base; and

wherein either the dihydroxyaromatic or the dihaloaromatic is present in an excess amount.

The Examiner relies on the following prior art references as evidence of unpatentability:

Keller US 4,259,471 Mar. 31,1981

Matzner	US 4,968,758	Nov. 6, 1990
Matzner	US 5,084,530	Jan. 28, 1992

Appellants rely on the following evidence in rebuttal:

Williams et al., “*Solvent assisted Ullmann Ether Synthesis. Reaction of Dihydric Phenols*” J. Org. Chem., 32, 2501 (1967) cited in Keller reference.

Hammann et al., “*Synthesis of Seven New Polyphenyl Ethers*” J. Chem. and Eng. Data, 15(2), 352 (1970), cited in Keller reference.

Declaration under 37 CFR 1.132 of Teddy M. Keller.

The rejections as presented by the Examiner are as follows:

1. Claims 1 and 2 are rejected under 35 U.S.C. § 102(b) as anticipated by Keller; and
2. Claims 22, 23, 26, 27, 56, and 58 are rejected under 35 U.S.C. § 103(a) as unpatentable over Matzner (4,968,758 or 5,084,530).

II. DISCUSSION

A. Anticipation by Keller

In rejecting claims 1 and 2 as anticipated by Keller, the Examiner finds that the Keller reference describes resins with $-(O\phi)_x-$ repeating units ($x=1-10$; ϕ =phenyl group) that are polyaromatic ethers within the scope of claims 1 and 2 when $x = 7, 8, 9$, or 10 (Answer 3). Appellants acknowledge that the Keller structures are within the scope of the claims when $x = 7, 8, 9$, or 10 (Br. 3-4). Appellants contend, however, that Keller “is not enabling for all disclosed values of x , including 7, 8, 9, and 10” (Br. 3). Specifically, Appellants contend that Keller fails to enable the synthesis of these polyaromatic ethers

(Br. 3). Appellants also contend that the Ullman ether synthesis referred to by Keller, in declarant Keller's expert opinion, cannot be used to make oligomeric or polymeric aryl ethers in high yield and high molecular weight (Br. 3 referring to the Keller Declaration).

Based on the contentions advanced in the Briefs and Answer the issue is: Have Appellants presented sufficient evidence to show that one of ordinary skill in the art would not be able to synthesize the polyaromatic ethers with values of x of 7, 8, 9, or 10 taught by Keller at the time of the invention?

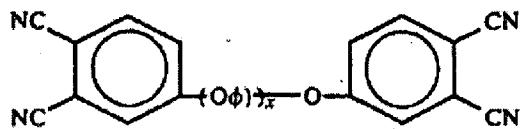
We select claim 1 as representative in deciding the above issue.

It is well settled that prior art under 35 U.S.C. § 102(b) must be "enabling", i.e., it "must sufficiently describe the claimed invention to have placed the public in possession of it." *In re Donohue*, 766 F.2d 531, 533, 226 USPQ 619, 621 (Fed. Cir. 1985). "Such possession is effected if one of ordinary skill in the art could have combined the publication's description of the invention with his own knowledge to make the claimed invention." *Id.* A reference is presumed to be enabling and therefore, once the examiner establishes that the reference teaches each and every limitation of the claimed invention, the burden shifts to the applicants to prove the reference is not enabling. *Chester v. Miller*, 906 F.2d 1574, 1578, 15 USPQ2d 1333, 1337 (Fed. Cir. 1990); *In re Sasse*, 629 F.2d 675, 681, 207 USPQ 107, 111 (CCPA 1980).

As acknowledged by Appellants, Keller describes resins and oligomers containing polyaromatic ethers within the scope of claim 1 (Br. 3-4). The burden, therefore, is on Appellants to show non-

enablement. Keller includes the following guidance on how to synthesize the resins:

The resins of the present invention are obtained by heating a bisorthodinitrile of the general formula:



wherein x is an integer from 1 to 10 and the phenyl groups are attached at the meta or para position. The bisorthodinitriles are prepared by a nucleophilic substitution of the nitrosubstituent of 4-nitrophthalonitrile with an aromatic diol. The aromatic diols are easily prepared by an Ullman ether synthesis. Further discussion of this type of synthesis can be found in Williams, A. L. et al. *Solvent-Assisted Ullman Ether Synthesis. Reactions of Dihydric Phenols*. In *Journal of Organic Chemistry* 32: p. 2501-05. August 1967 and in Hammann, W. C. et al. *Synthesis of Seven New Polyphenyl Ethers*. In *Journal of Chem. and Eng. Data* 15(2): p. 352-5. 1970.

(Keller, col. 3, l. 56 to col. 4, l. 8).

As shown above, Keller refers to Ullman ether synthesis generally as useful for synthesizing the aromatic diols. These diols are used to form the oligomers and resins containing the polyaromatic ethers. Keller further cites two references as discussing this type of synthesis, Williams and Hammann. In arguing that Keller does not enable the synthesis, Appellants argue that neither Keller nor Williams nor Hammann discloses synthesis of aromatic diols where x is 7 or above (Br. 3).

We cannot say that Appellants have provided sufficient evidence and/or reasoning to support a determination that those of ordinary skill in the art would not have been able to synthesize the $x = 7, 8, 9, \text{ or } 10$ aromatic diols of Keller. Looking at the issue through the facts of the cases that have construed “possession” in the context of what is enabling, we note that prior art references were found to be non-enabled when there was a complete absence of a known or obvious method of making the product in a stable form. *See In re Brown*, 329 F.2d 1006, 1011, 141 USPQ 245, 249 (CCPA 1964) (“[W]e do not think that Clark's reference to his *unsuccessful attempts* to prepare fluorine-containing silicone homopolymers would place such homopolymers in the possession of the public” (emphasis added)); *In re Sheppard*, 339 F.2d 238, 241-42, 144 USPQ 42, 45 (CCPA 1964) (“Emelus indicates a *complete lack of success* in preparation of pentafluorides” in a stable form (emphasis added)); *In re Hoeksema*, 399 F.2d 269, 274, 158 USPQ 596, 601 (CCPA 1968) (“[T]he *absence* of a known or obvious process for making the claimed compounds overcomes a presumption that the compounds are obvious.” (emphasis added)); *In re Collins*, 462 F.2d 538, 542-43, 174 USPQ 333, 337 (CCPA 1972) (“[T]he lack of a teaching in Collins of how to make the presently claimed heat exchangers vitiates the rejection unless there was *some* known or obvious way to make them.” (emphasis added)).

Appellants present no convincing evidence that those of ordinary skill in the art at the time of the invention would be unable to make the diols at issue. Keller states that the aromatic diols “are

easily prepared by an Ullman ether synthesis" (Keller, col. 3, l. 68 to col. 4, l. 1), and this provides evidence that those of ordinary skill in the art would have understood how to adapt an Ullman ether synthesis method to obtain the desired diols. Keller states that Williams and Hammann "discuss" Ullman ether synthesis. This language provided evidence that this "discussion" would have provided enough guidance to the skilled artisan to allow synthesis of all of the diols of Keller. That Keller, Williams, and Hammann do not expressly disclose forming $x=7$ or above diols, does not show that one of ordinary skill in the art would not understand how to adapt the Ullman ether synthesis method to form the higher repeating unit diols. An express articulation of such knowledge in the references is not required where it is evident that those of ordinary skill in the art possessed the knowledge. *See Motorola, Inc. v. Interdigital Tech. Corp.*, 121 F.3d 1461, 1472, 43 USPQ2d 1481, 1489 (Fed. Cir. 1997) and cases cited therein. Moreover, it is not necessary "that an invention disclosed in a publication shall have actually been made in order to satisfy the enablement requirement." *In re Donohue*, 766 F.2d 531, 533, 226 USPQ 619, 621 (Fed. Cir. 1985).

Appellants also rely upon the Keller Declaration in support of their contention of non-enablement (Br. 3-4). According to the Declaration, "[t]he Ullmann ether synthesis referred to in the Keller reference (US Patent No. 4,259,471) cannot be used to make oligomeric or polymeric aryl ethers *in high yield and high molecular weight.*" (Declaration ¶ 3 (emphasis added)). Enablement does not require synthesis in high yield, only the ability to synthesize.

Moreover, what declarant Keller means by “high molecular weight” is not clear. The evidence does not convince us that those of ordinary skill in this art would not have known how to synthesize the x=7-10 aromatic diols of the Keller reference.

Appellants have not satisfied their burden of showing that the Keller reference is not enabling with respect to the subject matter of claim 1.

With respect to claim 2, Appellants note that this claim limits the $\text{--}(\text{O--Ar--})_n\text{--}$ repeating unit of claim 1 to those where the Ar groups are m- or p-phenylene and contend that these compounds are not enabled by the Keller reference (Br. 4). However, Appellants only argue that, in Hammann, the longest chain having only phenylene groups has x=3. Again, the fact there is no express disclosure of longer repeating units does not suffice to overcome the presumption that Keller is an enabled reference for all the compounds disclosed therein.

We sustain the rejection of claims 1 and 2 under 35 U.S.C. § 102(b) as anticipated by Keller.

B. Obviousness over Matzner

The Examiner rejects claims 22, 23, 26, 27, 56, and 58 as obvious over two related Matzner references.² These references are directed to block copolymers containing poly (aryl ether) blocks and poly(aryl ether ketone) blocks (*see, e.g.*, Matzner '758, col. 4, ll. 8-16).

² The US 5,084,530 reference is a divisional of US 4,968,758, and the two references have substantially the same disclosures.

Appellants contend that the compounds of Matzner contain carbonyl groups between aromatic groups and such is excluded from the scope of the claims (Br. 5). Appellants further contend that the processes of Matzner produce only polymers containing carbonyl groups in the main chain, no other processes involving a base and a copper compound are disclosed (Br. 5). The Examiner contends that the claims do not exclude the carbonyl groups of Matzner (Answer 5).

The issues are: (1) Are the claims open to the presence of the carbonyl groups disclosed by Matzner? and (2) Has the Examiner provided sufficient evidence showing that Matzner describes a process involving a base and a copper compound for making the claimed compounds?

The resolution of the first question requires a determination of the scope of the claims. During examination “claims . . . are to be given their broadest reasonable interpretation consistent with the specification, and . . . claim language should be read in light of the specification as it would be interpreted by one of ordinary skill in the art.” *In re Am. Acad. of Sci. Tech. Ctr.*, 367 F.3d 1359, 1364, 70 USPQ2d 1827, 1830 (Fed. Cir. 2004).

Looking at claim 22 as representative, we note that this claim is directed to a process of preparing a polyaromatic ether comprising the formula $-(\text{O}-\text{Ar}-)_n-$.

With regard to the identity of the “Ar” group, we read the claim clause in concert with the Specification (e.g., Specification ¶¶ 20-21). In this formula “Ar” is an independently selected divalent aromatic radical. The radical can be any divalent radical with or without

substituents containing one or more fused aromatic rings.

Alternatively, the radical can be “one or more non-fused aromatic rings without intervening functional groups.” The only other option for the “Ar” group is a combination of the two alternatives recited above. Therefore, where “Ar” includes fused rings, there can be substituents on the radical. Where “Ar” includes two or more non-fused rings, there can be no functional groups between the rings. Where “Ar” is one non-fused ring, the language “no function groups between the rings” cannot apply.

Importantly, “n” is not limited by the claim. We, therefore, interpret the claim as allowing n=1. The claim only requires the presence of one $\text{--}(\text{O--Ar--})\text{--}$ structure.

We also note the use of the transitional phrase “comprising.” The use of “comprising” means that the claim is open to the inclusion of other structures in addition to the recited $\text{--}(\text{O--Ar--})_n\text{--}$ structure.

Based on the above analysis of the claims, we determine that claim 22 encompasses a process of making a polyaromatic ether with one $\text{--}(\text{O--Ar--})\text{--}$ structural group where “Ar” is a single aromatic ring. We also determine that because the claim uses the transitional phrase “comprising,” the claim does not exclude carbonyl groups in other portions of the structure.

Matzner describes polyaromatic ethers meeting the requirements of claim 22. See, for instance, formula (28) in columns 17 and 18 of Matzner. Formula (28) illustrates a block copolymer containing $\text{--}(\text{O--Ar--})\text{--}$ structural groups wherein “Ar” is a single aromatic ring, i.e., a phenyl group. While other sections of the

formula (28) compound include carbonyl groups, those are not excluded by the claim.

With respect to the issue of whether the Examiner has shown that Matzner suggests a process of preparing the compounds of the claims, we determine that such a suggestion is present with regard to claim 22 (e.g., Matzner '758, col. 18, ll. 1-13; col. 23, ll. 53-55), but the Examiner's findings fall short with regard to the aromatic ether oligomer of claim 26.

The Examiner points out that Matzner describes an aromatic ether oligomer formula starting at column 5, line 20 that encompasses the oligomers of claim 26. The Examiner further finds that Matzner discloses the process of preparing "said polyaromatic ether" citing various portions of the references directed to the preparation of the block copolymer (Answer 4). The Examiner has not cited any portion of the reference directed to making the compounds of column 5, line 20. The Examiner, therefore, has not presented sufficient evidence that Matzner suggests a process of reacting a dihydroxyaromatic with a dihaloaromatic in the presence of a copper compound and a base to prepare the oligomer in accordance with claim 26.

With respect to claims 23 and 27, Appellants point out that these claims limit the copper compound to CuI or CuBr, compounds not disclosed in the Matzner references (Br. 5). We consider the Appellants' contention with respect to claim 23 only as claim 27 is dependent on claim 26, and, therefore, the rejection of claim 27 fails for the reasons given with respect to claim 26.

Matzner's disclosure with regard to the identity of the copper compounds is as follows:

All of the reactions discussed above may be advantageously performed in the presence of small amounts of cupric or cuprous ions. A wide range of copper compounds may be used, both cupric and cuprous compounds being usable in accordance with the present invention. The copper compounds used should be stable under the polymerization conditions and it is preferred that the copper compounds be essentially anhydrous. Copper compounds which can be used include cuprous chloride, cupric chloride, cupric acetylacetone, cuprous acetate, cupric hydroxide, cuprous oxide, cupric oxide, basic cupric carbonate and basic cupric chloride.

(Matzner '758, col. 23, ll. 53-64).

The disclosure that a wide range of copper compounds can be used coupled with Matzner's examples of the related halogenated copper, cuprous chloride (CuCl), would have suggested the use of other halogenated coppers including CuI and CuBr to one of ordinary skill in the art particularly since there are only four useful members of the halogen genus.

We sustain the rejection of claims 22, 23, and 56 under 35 U.S.C. § 103(a) as obvious over the Matzner references. We, however, do not sustain the rejection of claims 26, 27, and 58 on those grounds.

III. DECISION

We sustain the rejection of claims 1 and 2 as anticipated by Keller. We sustain the rejection of claims 22, 23, and 56 as obvious

Appeal 2007-0650
Application 10/808,264

over the Matzner references. We do not sustain the rejection of claims 26, 27, and 58 over the Matzner references.

Accordingly, the Examiner's decision is AFFIRMED-IN-PART.

IV. TIME PERIOD FOR RESPONSE

No time period for taking any subsequent action in connection with this appeal maybe extended under 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED-IN-PART

tlc/ls

NAVAL RESEARCH LABORATORY
ASSOCIATE COUNSEL (PATENTS)
CODE 1008.2
4555 OVERLOOK AVENUE, SW
WASHINGTON, DC 20375-5320